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ABSTRACT

A summative evaluation of the effectiveness of the educational television series, "Statistics," that aired on South African television is presented. The two episodes chosen from the six-episode series covered pie charts, pictograms, and pictographs (episode 1); and point-of-view interpretations of statistics (episode 4). The evaluation was designed to determine the degree to which the episodes were successful in communicating an awareness of elementary statistics, relating statistics and its uses to everyday life, providing background and reinforcement for the introduction of statistics to the secondary school curriculum, and indicating to instructors ways in which statistics can be taught in a relevant and lively manner. The evaluation involved 291 test and 152 control students attending secondary school. Data were gathered via objective tests concerning the viewers' content knowledge, ability, and attitudes toward statistics. Test findings indicate that, in general, the series was successful. The material has been used most successfully as an aid in teaching statistics to secondary-school students who are also undergoing more conventional methods of teaching. Post-viewing discussion periods were found to be exceptionally valuable. (TJH)

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EVALUATION OF THE TV SERIES "STATISTICS" (SABC-ERTV1)

by

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EVALUATION OF THE ETV PROGRAMME
"STATISTICS" ERTV1, SABC

Introduction

A preliminary research several months before the broadcast was carried out on a random sample of 54 pupils. This preliminary investigation facilitated the design of the test instruments, as well as the choice of the particular episodes chosen for evaluation.

This preliminary investigation indicated that the series on Statistics could be divided into ***two*** *main sections, viz:*

Section 1:	***Section 2:***
Episode 1	*Episode 5*
Episode 2	*Episode 6*
Episode 3	
Episode 4	

Section 1 consists of instruction in ***descriptive statistics,*** *while Section 2 deals with* ***probability theory.*** *It was decided to evaluate Section 1. The reasons for this were,* ***inter alia,*** *that the content of Section 1 is largely covered in the Junior Secondary Mathematics syllabus, and that it seemed from the preliminary investigation that the conceptual level of the content of episode 5 and episode 6 was too high for this audience.*

The two episodes chosen for the summative evaluation were ***Episode 1*** *and* ***Episode 4.***

Episode 1: *"Pie charts, Pictograms, Pictographs"*

Episode 4: *"Point of view. (or how to lie with statistics)"*

The ultimate aim of the evaluation was to determine the degree to which the episodes under investigation succeeded in achieving the **goals** of the series:

Goals of the Series:

1. **To communicate an awareness of elementary statistics**
2. **To relate statistics and its uses to everyday life**
3. **To provide background and reinforcement the introduction of statistics to the secondary school syllabus**
4. **To indicate to the teacher ways in which statistics can be taught in a lively and relevant manner**

Target Audience

The series was originally designed to be of educational value to all age groups and all reasonable educational levels. The broadcast **time** however, restricted the target audience to young school pupils. The time slot devoted to the series was 17h15 on a Monday evening. The time-slot was previously and subsequently devoted to broadcasts of ETV material aimed at primary-school (or possibly junior-secondary) pupils. The exclusion of the programme from the Saturday morning ETV time slot contributed further to the restriction of the target audience.

Test Sample

The samples for the two detailed evaluations were randomly selected from pupils at a secondary school.

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	Test	Control	Total
Episode 1	170	22	192
Episode 4	121	130	251
TOTAL:	291	152	443

Test Instruments

In both cases, the data was gathered by means of objective test questionnaires testing both content knowledge and ability, as well as attitude towards statistics. Further non-quantitative data was gathered by means of interviews and clinical observations of the test and control groups.

Methodology

The video tape of the series (all six episodes) was shown to the test sample, one episode at a time. By using this method, the researcher could be certain that the control group had no exposure to the ETV material - which would have been impossible had the research been carried out after the broadcast date. The test sample was carefully observed as to their reaction and general behaviour during and after the viewing of the series.

Administration of the Test Instruments

The tests were administered under strict examination conditions. Each subject was given an "examination number", in which was coded the sex, school level, degree of exposure to statistics (formal), and assessed mathematical ability. The subjects were unaware of the meaning or significance of these codes.

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Statistical Methodology

The data was scored, and divided into frequency groups according to the categories under investigation. Hypotheses concerning frequencies were tested using the ***CHI-SQUARED*** *method of hypothesis testing.*

Summary of Test Finding

A: Ability in Statistics

1. *Effect of Assessed Mathematical Ability on the Test Scores*

If we formulate the null hypotheses: ***"Mathematical ability has no effect on the test scores":***

Episode 1:	***r=0,997***	***reject null hypothesis at 0,50 level of significance***
Episode 4:	***r=0,921***	***TEST SAMPLE: reject at 0,99*** ***CONTROL : reject at 0,995***

It is apparent from the above that the assessed mathematical ability played a very significant part in the test scores. This is particulary noticeable in the case of Episode 4, where the control group relied almost exclusively on their mathematical ability to score in the test. In the case of the control group in Episode 4, we are 99.5% certain that we are not rejecting the null hypothesis while it is ***true.***

The slightly lower coefficient of linear correlation for Episode 4, (Episode 1 r=0,997; Episode 4 r=0,921) is consistent with the test instruments, which did not require much mathematical expertise in Episode 4. The test items were more a test of judgmental rather than mathematical/calculating ability.

2. *The Effect of the ETV Material on the Test Scores*

	Episode 1						Episode 4				
	1	2	3	4	Tot		1	2	3	4	Tot
Test	72%	90%	89%	60%	170	Test	81%	81%	73%	77%	121
Control	68%	77%	86%	41%	22	Control	61%	66%	69%	57%	130

If we formulate the null hypothesis: "Viewing the ETV programme 'Statistics' had no effect on the test scores", we can ***reject the null hypothesis*** *at the following levels of significance:*

Episode 1: Reject at 0,50 level

Episode 4: Reject at 0,90 level

We can therefore be confident in stating that Episode 4, particularly, resulted in a significant change in the test scores (improvement). The situation for Episode 1 is not so significant, although there is still a reasonable significant level for the rejection of the null hypothesis.

3. *The Effect of Number of Years Formal Schooling on the Scores*

We formulate the null hypothesis: ***"Number of years formal schooling has no effect on the test scores"***

For Episode 1: we can reject the null hypothesis at the 0,50 level of significance. This is once again a rather low significance level, which could suggest that the material handled in Episode 1 was largely of an intuitive nature, and that formal training in such elementary topics had little effect.

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For Episode 4: For the ***test sample*** *we can reject the null hypothesis at a significance level of 0,90. For the* ***control sample*** *we can reject the null hypothesis at a significance level of 0,975. The coefficients of linear correlation for the episode are:* ***Test sample - r = 0,813; Control sample - r = 0,913; Combined - r = 0,579.*** *The very high linear correlation as well as the very high significance level for the rejection of the null hypothesis indicate that the* ***control group*** *relied almost entirely on their experience and maturity to complete the test material. The low coefficient of correlation for the* ***combined*** *samples is a very powerful indicator of the highly significant difference between the scores of the test and the control groups - i.e. it is an indicator of the considerable effect of the episode on the scores.*

Summary of results

Episode 1

The assessed mathematical ability was by far the most significant factor affecting the test scores for this episode. This is consistent with the material covered in Episode 1 - which was largely the ability to construct and to interpret graphs of various types. Perhaps it was unnecessary to devote a complete episode of the series to such elementary topics.

The effect of the number of years formal schooling, and the effect of the viewing of the episode had a very much lower significance in affecting the test scores. This is consistent with the view expressed above.

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Episode 4

Episode 4 showed a highly significant effect on the test scores. (0,90 significance level). Assessed ability in mathematics and number of years formal schooling also had a highly significant positive effect on the scores. The affect of formal schooling is probably explained by the fact that there is a direct relationship between cognitive maturity and years schooling, a factor which would affect the scores more than simply schooling in mathematics. A high degree of interpretive and subjective judgmental ability was needed to correctly respond to the test items for Episode 4. Similarly, there is a high positive correlation between intelligence and ability in mathematics, and it is probably this former factor that caused the significant effect of "assessed ability in mathematics", rather than mathematical ability as such.

Attitude Towards Statistics

The identical test items were given to the two groups under investigation (Episode 1 and Episode 4)

Question 10:	***Episode 1***	***Episode 4***	
	56%	*66,9%*	*Keen to learn more statistics*
	16%	*14%*	*No desire to learn more statistics*
	28%	*19%*	*Did not care whether they learned more or not statistics*

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From the above it is apparent that Episode 4 had a more positve effect than Episode 1, but that they **both** *the episodes showed a significant positive response to the question: "Do you wish to learn more about statistics?*

Question 9: Was the episode ... 1=no help at all ... 5=a great help .. in the understanding of statistics?

response	*Episode 1 frequency*	*Episode 4 frequency*	*(%)*
1	*3%*	*2.5%*	
2	*15%*	*11.6%*	
3	*42%*	*38.8%*	
4	*29%*	*34.7%*	
5	*10%*	*12.4%*	
MEAN	*3,38*	*3,43*	

The rather low mean response could be because the two episodes in fact were little help in facilitating the ability to perform the tedious calculations required in a typical secondary-school course in statistics. This could be interpreted as a criticism of the method of teaching statistics at school, where the "processes" rather than the "products" of the subjects are drilled, often at the expense of a true conceptual understanding.

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Attitude Towards the Programme

LIKES:	*Episode 1*	*Episode 4*
	31.2% ... Examples	*42.9% ... Examples*
	17.8% ... Explanation	*30.6% ... Humour*
	15.9% ... Relevance	*19.0% ... Relevance*
	13.4% ... Format/Layout	*14.0% ... Format/Layout*
	5.7% ... Use of Diagrams	*7.4% ... Use of diagrams*
	10.2% ... Miscellaneous	*10.7% ... Miscellaneous*
	5.7% ... Nothing	*7.4% ... Nothing*

DISLIKES:	*Episode 1*	*Episode 4*
	31.8% ... Presenter	*47.1% ... Presenter*
	19.9% ... Too simple	*14.0% ... Too simple*
	7.3% ... Too short	*7.4% ... Too short*
	3.9% ... Not clear	*7.4% ... Not clear*
	6.6% ... Miscellaneous	*9.1% ... Miscellaneous*

There is a very high degree of concordance between the two sets of responses to this attitudinal test item. It is noteworthy that ***humour*** *scored prominently as a "like" in Episode 4 - this is certainly consistent with all accepted theories of education. More use could have been made of humourous situations throughout the series. The greatest positive feature in both the episodes was the example(s) chosen to illustrate the concepts involved. (Kruger Park in Episode 1, and the "salesman" situation in Episode 4). Both examples chosen were* ***relevant to the experience of the learner*** *- a crucial factor in any lesson design.*

The most common "dislike" was ***the presenter.*** *It appeared to both the target audience (test group) and to the researcher that the presenter was not entirely proficient in the subject that was being presented. It is an essential pre-requisite in any lesson design*

that the teacher be an expert in the field of study. Many of the test group felt that the presenter tended to "talk down" to the audience. This view is consistent with the other prevalent dislike, i.e. that the programme was too simple. Episode 1, in particular, seemed to devote too much time and emphasis to trivial concepts, that could be easily understood with an elementary understanding of graphs. The criticism that the programme was "too short" could in fact be taken as a highly positive criticism. It is the hallmark of a good lesson to leave the subjects with a desire to learn more. Both Episodes seemed to have succeeded in this respect.

Conclusion

Need for the Programme

In general there seems to be a serious lack of conceptual understanding of even the most basic statistical principles, even amongst those candidates with several years of "formal" exposure to the subject. Both the episodes under evaluation contributed towards such a conceptual understanding. Episode 4 in particular was most successful in making the viewers aware of the possibilities of abusing statistics.

Aims of the Programme

1. *To communicate an* ***awareness*** *of elementary statistics.*
   The episodes evaluated contributed towards the creation of an awareness of statistics as it could be applied in daily life.

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2. To **relate** statistics to **everyday life**

   The episodes succeeded in showing the application of statistics to everyday life situations. The choice of examples - animal census in the Kruger Park in Episode 1, and the abuse of statistics by a salesman in Episode 4, were both very well chosen. The examples were within the real - life experience of the target audience.

3. To provide **background and reinforcement** to the introduction of statistics to the secondary school syllabus. The episodes evaluated do contain material that is specifically mentioned in the syllabus for mathematics for the Junior Secondary course, so they do fulfill the stated aim. Episodes 5 and 6, however, are outside the syllabus, so would not necessarily meet this aim, except perhaps as a reinforcement (enrichment).

4. To indicate to the teacher ways in which statistics can be taught in a **lively and relevant** manner.

   This aim could have been achieved far better if the following points had been considered before production:

   (a) A better, facilitative teacher should have been chosen to present the programme

   (b) Better use should have been made of the potential of the medium. e.g. it was inexcusable to manually draw charts, diagrams, etc., which were sometimes very difficult to decipher. Use should have been made of computer aided graphics, where, for example, the **dynamic** nature of the construction of descriptive diagrams could have been

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illustrated. Apart from the excellent location material from the Kruger Park, too much use was made of the studio, which in itself was unimaginative and dull.

In general, it is felt that the evaluated episodes (and in fact the entire series) ***failed to indicate to the teacher ways in which statistics can be taught in a lively and relevant manner, because a good facilitative teacher possibly could have done it better.***

Time Schedule for the Series

The time slot allocated for the series (17h15 on a Monday). Not only adults, but many secondary school pupils found it impossible to view the series due to commitments at work and at school. The series was ***not included*** *in the Saturday morning re-broadcast of educational material, which could have overcome this serious drawback. The 'educational programmes' that preceded and succeeded the 'Statistics' series were designed for a less academically mature audience than that envisaged for the series. Of 56 Standard 10 pupils interviewed, only 7 had realised that there was a series on statistics. The pre-broadcast advertising/publicity was almost non-existent.*

General

In general the series was successful in meeting the majority of the original objectives. The ETV material has been used most successfully as an aid in the teaching of statistics to secondary-school pupils.

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The series is valuable when used ***in parallel*** *with more 'conventional' methods of teaching. Post-viewing discussion periods were found to be exceptionally valuable. The video tape of the series has become an essential aid to teachers of mathematics at some schools.*

The complete data and statistical analysis can be found in:

STUPART, J.D.C. *and* ***DUBY, A.*** ***Impact Evaluation of Episode 1 and 4 of the ETV Series "Statistics".*** *(Internal executive report)* ***Johannesburg: Educational Programmes RTV1, SABC, and can be obtained from: Dr A. DUBY, ERTV1, SABC, P.O. Box 8606, JOHANNESBURG, 2000 RSA.***